NebGuide

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Creating a Solitary Bee Hotel

Erin C. Bauer, Extension Associate
Louise I. Lynch, Graduate Research Assistant
Doug A. Golick, Assistant Professor
Tom J. Weissling, Associate Professor

This NebGuide examines the benefits of installing solitary bee hotels in your landscape, and how to build them.

Many people are familiar with honey bees, which originate from Europe and are major pollinators of the world's crops. What some people don't realize, however, is that there are thousands of native and non-native solitary bee species that also aid in pollination. Solitary bees, unlike honey bees, do not live in a social structure. Some solitary bees nest in natural and man-made cavities. These can easily be provided with nesting habitats.

Cavity-nesting solitary bees

Each cavity-nesting female bee makes nests in locations where long, tube-like holes are abundant, such as hollow twigs, abandoned beetle burrows and tunnels in sides of buildings, soil, plant stems, or near foundations. Once a female solitary bee has chosen a nesting spot, she will build cells, and provide them with a single egg and food (nectar and pollen). In late spring, males emerge first, wait for females to emerge near nests, and mate with them. A mated female will then begin constructing cells for her offspring. Solitary bees will often nest in the same area year after year, if the nest site meets their needs. While solitary bees are not social, some are communal and may build nests close to one another. Solitary bees make many trips to collect nectar and pollen from flowering plants for their nests; thus they serve as important pollinators.

Solitary bees vary in color and size. Many solitary bees are about ¼ - ¾ inches in size and may be dark-colored, or metallic green or blue. Commonly observed solitary bees include mason bees, leafcutter bees, and carder bees. Solitary bees are appealing in landscapes because they rarely exhibit defensive behaviors, only stinging if mishandled or if they become entangled in clothing. Further, a solitary bee sting is often less painful than a honey bee. Many species are even stingless. Active from spring through the summer, these bees are effective pollinators of many orchard fruits and vegetables and aid in crop seed production.

Mason Bees (*Osmia* species) — Mason bees *(Figure 1)*, such as the blue orchard bee *(Osmia lignaria)*, are the size of honey bees and black to dark metallic green or blue in color. As the name suggests, blue orchard bees (BOB) are effective pollinators of orchard fruits. The hornfaced bee *(Osmia cornifrons)*, a native of Japan, was introduced into the U.S. in the 1970s and is often used to pollinate apple orchards. They are smaller than the blue orchard bee and brownish yellow with light stripes. They have "horn" structures on their heads to help scoop up mud for nest building. New adults develop in the nest over the summer but will not emerge until the following spring. The mason bee carries pollen in a scopa, a group of stiff hairs on the underside of its abdomen.

Figure 1. Mason bees. Photos: University of Nebraska–Lincoln

Leafcutter Bees (*Megachile* species) — Leafcutter bees *(Figure 2)* are small to medium-sized bees with stout bodies, dark coloration, and bands. The alfalfa leafcutter bee *(Megachile rotundata)* is a small bee, native to Europe, which pollinates alfalfa as well as other fruits and vegetables. Like mason bees, the leafcutter bee also has a scopa on the underside of its abdomen for carrying pollen. They have large, scissor-like mandibles (mouthparts) to cut leaves, flower petals, or other vegetation to create their nest chambers *(Figure 3)*. Females often build more than one nest. They will rest in the nest during the night and resume building in the morning. The end of the nest tunnel is capped off with circular leaf pieces. This leaf cutting activity does not harm plants.

Figure 2. Leafcutter bee nesting. Photo: University of Nebraska–Lincoln

Figure 3. Leafcutter bee activity on rose, oak and other leaves. Photo: University of Nebraska–Lincoln

Carder Bees (*Anthidium* species) — Carder bees *(Figure 4)* are stocky, dark-colored bees with yellow or black markings and may resemble wasps. Their name refers to their habit of collecting plant hairs, similar to carding wool. The females use their toothed mandibles and abdomen to comb hairy plant leaves and stems and use the soft material to build nest chambers. Males will patrol for females and can be territorial, but are harmless because they cannot sting.

Figure 4. Carder bee. Photo: University of Nebraska–Lincoln

Why help bees…they pollinate!

Bees and other animals are responsible for the pollination of more than 60% of flowering plants, including 95 crops in the U.S. that are pollinated by honey bees alone. Without bees and other pollinators, we would not have foods like blueberries, almonds, chocolate, and coffee.

Unfortunately, honey bees, the most utilized pollinators managed by humans, have been threatened in recent years by Colony Collapse Disorder (CCD). This disorder, which causes hive mortality, is still under investigation by researchers. It is important to attract, study, and conserve all of our pollinators, even more so with declining honey bee populations.

What you can do to help…build a bee hotel!

While female solitary bees nest individually in naturally occurring cavities, they can be encouraged to nest locally by providing a "bee hotel." Building a bee hotel requires just a few key materials. First, create a frame, or wooden box, that is open in the front and closed in the back with a roof to keep rain from saturating the nesting blocks *(Figure 5)*. Second, create several nesting blocks (enough to fill the frame) *(Figure 6)*. Nesting blocks can be made from pieces of wood, such as small logs or 2" X 4"s cut into smaller pieces.

The bee hotel outer structure and nesting blocks can be made from a variety of common wood such as pine, spruce, and oak. See *Figure 5* for examples. **Do not use pressure-treated wood, as the chemicals infused into the wood may be harmful to nesting bees.** Cedar can be used, but it should be seasoned. Fresh cedar's aromatic nature may repel some bees.

Wood may be found around the home (i.e. cut limbs from pruning and logs) or through construction companies that may have scrap wood. Using such wood is a great way to reuse what might otherwise be discarded. Be sure to only use wood from your local area to prevent the spread of tree diseases and other pests.

Construction Instructions

Create the hotel frame — When placed outside, drilled nesting blocks alone can suffice as solitary bee habitat (see "Create nesting blocks" section below). However, bee hotel

frames are a creative way to offer nesting areas to many more solitary bee species. In general, a good guideline for a bee hotel frame is at least 6 inches deep X 10 inches wide. However, there are no specific standards, so experiment! For example, a medium-sized bee hotel frame *(Figure 7)* might be 6-7 inches deep, 12 inches high, 12 inches wide, with an open front, and a covered back. The frame should also include a sloping "roof" to deflect rain. One or two coats of Danish oil, available at hardware stores, may be applied as a protectant. Allow several days for Danish oil odor to dissipate before installation.

Figure 5. Examples of frames. Photo: University of Nebraska–Lincoln

Figure 6. Examples of bee hotels. Photo: University of Nebraska–Lincoln

Figure 7. A medium-sized bee hotel. Photo: University of Nebraska–Lincoln

Create nesting blocks — To encourage nests of different bee species, blocks of wood should be up to 6 inches in length, with tunnels of various hole diameters (1/16 – 5/8 inches) drilled into them *(Figure 8)*. Hole diameter determines the depth of a tunnel, which should not breach the back of the wood block *(Figure 9)*. The larger the diameter, the deeper the tunnel needs to be drilled. In addition to wood blocks, logs, or posts, bamboo or pithy reed grasses, ½ inches in diameter and under, may be used as nesting structures. Holes of varying diameters provided by these tubular plants will help to attract different species of solitary bees. Using sand paper, smooth any rough edges on the holes, and remove any sawdust before setting the bee hotel out for occupancy.

The nesting blocks and tubular plant materials should be placed and packed tightly in the bee hotel frame. Do not use glue to secure nesting materials to the frame, as these materials need to be replaced yearly.

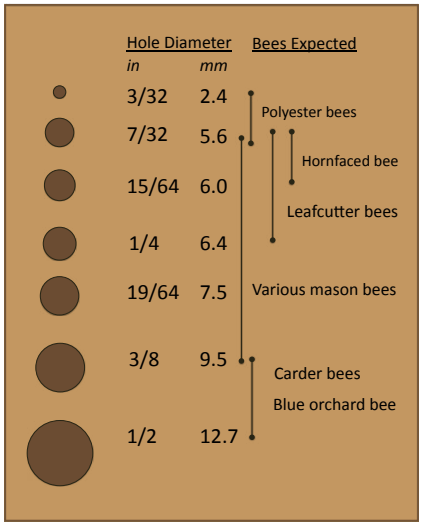

Figure 8. Hole diameter affects the type of bee that will be attracted to the nesting block. Illustration: University of Nebraska–Lincoln

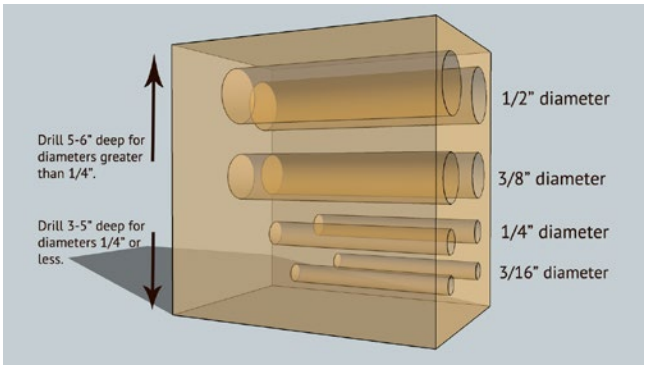

Figure 9. Depth depends on the diameter of the hole, with larger diameters requiring deeper drilling. Illustration: University of Nebraska–Lincoln

Installation of Bee Hotel and Observing Solitary Bees

Bee hotels are best installed during the spring, before mid-April, to prepare for the first generation of solitary bees emerging and searching for homes. The front of the bee hotel should have direct sunlight throughout most of the day, facing South to Southeast, to provide warmth to the growing immature bees. Bee hotels should be placed 3 to 5 feet off of the ground. Trim any vegetation blocking the front of the hotel. Mount the bee hotel on a 4x4 fence post *(Figure 10)* or to another structure by screwing through the front of the hotel frame, through the closed back, and into the structure.

Figure 10. Bee hotel mounted on a fence post in a garden. Photo: University of Nebraska–Lincoln

Bee hotels will have activity primarily during early and mid-summer, with a variety of solitary bees visiting and using them for nesting. A female bee will construct individual chambers, called cells, throughout the length of a tunnel. She will build a small pollen mass in a cell, deposit an egg, isolate the cell with mud (i.e. mason bees) or plant materials (i.e. leafcutter and carder bees), deposit pollen with another egg, and use mud or plant materials to form another cell. She may use several tunnels, filling each with many cells. Depending on the species, once a tunnel is full, she will cap it with mud or plant material to seal it from the elements, predators, and parasites *(Figure 11)*.

Just prior to fall's first hard freeze, nesting blocks with capped holes can be moved to an outdoor location that is protected from rodents, woodpeckers, and the elements. Discard unused nesting blocks. Leave the empty frame where it is. Solitary bees overwinter as pupae or adults in the capped nesting holes. Adult bees will emerge from their nest holes the following spring and early summer when the weather warms. Observe blocks daily from April to June for emerging adult bees. Once the blocks have been evacuated (by mid-summer), discard the old wood or use in compost or campfires.

Figure 11. A nest cavity cross-section, showing bee larvae and nest materials (top and middle). Capped nest entrances (bottom). Photos: University of Nebraska–Lincoln

After bees have emerged in the spring, insert new nesting blocks and tubular plants in the empty bee hotel frame. Never reuse the old nesting blocks or tubular plant material as this can promote the spread of disease to the next generation of bees.

Summary

Solitary bees provide a great service by pollinating flowering plants and crops. Local populations of solitary bees can be increased by providing nesting habitat. Creating bee hotels is an easy way to engage in meaningful environmental stewardship and help native and non-native pollinators.

References

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